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(54) Designation: Process for the sequentially interconnected stamping of sheet-metal strips

(71) Applicant: Siemens AG, 1000 Berlin and 8000 Munich

(72) Named as inventor: Kurt GROMER, of 5230 Unteröwisheim

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(56) Publications which have been taken into consideration for the evaluation of patentability:

German Patent 1,042,441

German Patent 133,849

Swiss Patent 189,200

US Patent 3,107,566

US Patent 3,338,084

"American Machinist", April 1, 1963, pages 96 - 99

"Werkstatt und Betrieb", March 1961, pages 159 - 161

DT 1,652,940

Translated by COSMOPOLITAN TRANSLATION BUREAU, INC., 53 W. Jackson Blvd., Chicago, 60604, 726-2610. Date Dec.27 19 92

From German Into English

Patent Claim:

Process for the sequentially interconnected stamping of sheet-metal strips with the aid of tooling combinations composed of individual tools, in which process the advancing of the strip after each power stroke is accomplished in the length of one spacing, and by which process, in order to compensate for lateral curvatures of the strip, narrow grooves proceeding inwards from the external edge are created by the first individual tool in the sheet-metal strip at the spacing boundaries at right angles to the direction of said strip, which process is characterized in that at least one narrow cut-out is always created at the spacing boundaries parallel to the grooves in the sheet-metal strip.

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The invention relates to a process for the sequentially interconnected stamping of sheet-metal strips with the aid of tooling combinations composed of individual tools, in which process the advancing of the strip after each power stroke is accomplished in the length of one spacing, and by which process, in order to compensate for lateral curvatures of the strip, narrow grooves proceeding inwards from the external edge are created by the first individual tool in the sheet-metal strip at the spacing boundaries at right angles to the direction of said strip.

For the mass-production of stamped parts, in many instances the technique of sequential interconnection represents the most economical solution. For complicated parts, a great many sequences with relatively large spacing are often required. The stamped strips, from the first sequence up until the finished part, are very long for this reason. Given the usually compact construction format of the tooling arrangement, this fact is conducive to interconnected tools of lengthy sequence with complicated assembly, the dimensional

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accuracy of which can be ensured only with difficulty. It often happens, therefore, that additional, subsequently associated operations are necessary. With tools of such length, a possibly occurring lateral curvature of the strip cannot be overcome.

In regard to the sequentially interconnected stamping of sheet-metal strips, it is already well known from US Patent 3,107,566 how provision may be made for narrow grooves proceeding inwards from the external edge in order to prevent lateral curvatures of the sheet-metal strip at right angles to the direction of the strip. Compensation for lateral curvatures is, to be sure, possible to a certain degree by these means. On the other hand, in the case of sequentially interconnected stamping with tooling combinations composed of individual tools, over and above that, due to tolerances in the intervals between the individual tools, there arise errors of spacing which are not susceptible to compensation by the process of prior art.

Underlying the invention, therefore, is the problem of specifying a process by means of which, not only the lateral curvatures of the sheet-metal strip, but also errors of spacing can be compensated for. This problem is solved, according to the invention, by the fact that at least one narrow cut-out is always created at the spacing boundaries parallel to the grooves in the sheet-metal strip.

It should be mentioned that the application of cut-outs in metal-transforming processes, such as drawing or embossing, is known in principle from US Patent 3,338,084 and from German Patent 1,042,441. In the present instance, however, the cut-outs serve an altogether different purpose: namely that of enabling the material to flow.

The view-finders of the individual tools can again and again capture such a strip accurately. For this reason the technique of sequential interconnection can be utilized as well with those stamped strips that are so long as to have necessitated the use of other techniques up until now.

If the individual tools are placed in sequence at close intervals one after the other on the stamping machine and are fixed on spacing, then the expanding cross-pieces are normally located during the power stroke between the individual tools and they absorb elastically both the spacing errors and the lateral curvatures. Thus it will suffice, in the arrangement of the individual tools, to maintain the spacing at a few tenths of a millimeter.

Figure 1 shows a sequentially interconnected tool with a successively arranged individual tool in the usual embodiment. By implementation of the process according to the invention, tooling combinations are constituted from individual tools, such as represented by way of example in Figure 2. Figure 3 shows a stamped strip with expanding cross-pieces, and Figure 4 -- enlarged -- shows an embodiment of the expanding cross-pieces. Expanding cross-pieces 1 and 2 of the exemplified embodiment represented in Figure 4 are created from the border of the strip by two narrow grooves 3 and 4 disposed in the same direction and proceeding at right angles to the direction of the strip itself, and by the narrow cut-out 5 which is disposed at a right angle to the direction of the strip. The dimensioning of expanding cross-pieces 1 and 2 is determined by the considerations that these expanding cross-pieces must, on the one hand, afford an adequate flexibility to the strip, whereas they must also, on the other hand, afford an adequate stability for the effective forces required to advance the strip. The tooling combination of individual tools which is rendered possible by the expanding cross-pieces, as may be seen from Figure 2, permits the tools to be manufactured in the manner of slide-in technology. This feature has the advantage that, during manufacture of the individual tools, several tool-makers can work simultaneously on the various tools -- something that is not possible in the case of the usual sequentially interconnected tools, such as those represented in Figure 1. For this reason the time required for the manufacture of such tools is appre-

ciably less than that customarily employed up until now. Even the risks of tool manufacturing become less. Subsequent changes are, generally speaking, easier and less expensive to carry out. Moreover, the risk involved in the manufacturing of parts can be decreased for the very reason that especially vulnerable tools, which are now replaceable on an individual basis, may be produced as a matter of plant-reserve capacity.

It is also possible not to have to separate the strips provided with expanding cross-pieces immediately into individual parts, but rather to let them remain in their full length, so that subsequent processing operations, as, for example, washing, lubricating, spraying, assembling, etc., may be performed with the parts serially interconnected, after which the procedure of separating them may be undertaken.

One sheet of drawings attached

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STATE OF ILL. } SS.
COUNTY OF COOK

CERTIFICATION OF TRANSLATION Chicago, Illinois Dec. 27, 1992

This is to certify that the foregoing translation from German into English was made under the personal supervision of the undersigned by a qualified translator conversant with both these languages, and that, to the best of my knowledge and understanding, it is a true and complete rendition of the corresponding original document.

Signed: Cheryl C. Cole Title Administrative Assistant

Subscribed and sworn to before me, a Notary Public in and for Cook County, Illinois, on this 28th day of December 1992

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My Commission Expires July 13 1993

COSMOPOLITAN TRANSLATION BUREAU, INC.
53 W. Jackson Blvd., Chicago, IL 60604
(312) 726-2610

Patent No.: 1 652 940

Date of Application: Dec., 13, 1967

Title: Method for Sequential Compound Stamping of Sheet Metal Strips.

Applicant: Siemens AG, 1 000 Berlin and 8 000 Munich

Inventor: Gromer, Kurt, 5230 Unteroewisheim

Papers taken into consideration for the judgment of patentability of the patent:

DT-PS 1 042 441, DT-PS 133 849, CH-PS 189 200, US-PS 3 107 566, US-PS 3 338 084, "American Machinist", April 1, 1963, pages 96 to 99; "Werkstatt und Betrieb", March 1961, pages 159 to 161.

Patent Claim.

Method for sequential compound stamping of sheet metal strips with the aid of tool combinations consisting of individual tools, wherein the strip feed takes place in the length of a division after each operating stroke and wherein, for compensating side bends of the strip, small cuts by the first individual tool in the sheet metal strip at the dividing boundaries are created perpendicularly to the direction of the strip, said small cuts running from the outer edge towards the interior, characterized in that, at each of the the dividing boundaries parallel to the cuts, at least one small cutout is created in the sheet metal strip.

This invention deals with a method for sequential compound stamping of sheet metal strips with the aid of tool combinations consisting of individual tools, wherein the strip feed takes place in the length of a division after each operating stroke and wherein, for compensating side bends of the strip, small cuts by the first individual tool in the sheet metal strip at the dividing boundaries are created perpendicularly to the length of the strip, said small cuts running from the outer edge towards the interior, characterized in that, at each of the dividing boundaries parallel to the cuts, at least one small cutout is created in the sheet metal strip.

In many cases, the sequential compound process will represent the most economical solution for the mass production of stamping parts. Many sequences with relatively large divisions are often required for complicated parts. Consequently, the stamping strips from the first sequence up to the finished part become very long. This leads, when the customary compact construction method of the tool arrangement is used, to long sequential compound tools with a complicated design, the dimensional accuracy of which is difficult to guarantee sufficiently. Because of this, further subsequent machining operations are often necessary. With those long tools, a possibly occurring side bend of the strip is hard to control.

Archer

It has already been known from the US PS 3 107 566, to provide, vertically to the direction of the strip, small incisions running from the outer rim towards the interior, during a sequential compound stamping of sheet metal strips, in order to avoid side bends of the sheet metal strip. The leveling-out of the side bends is possible to a certain degree here. However, during a sequential compound stamping with tool combinations consisting of individual tools, additional division errors occur as a consequence of the clearances in the distances between the individual tools, which cannot be compensated by known methods.

This invention has the task to procure a method with which, besides leveling out side bends of the sheet metal, division errors as well can be compensated. This task is solved, according to this invention, in that, at each of the division boundaries, parallel to the cuts in the sheet metal strips, at least one small cutout is created.

We would like to mention that it has been known from the US PS 3 338 084 and the German patent DT-PS 1 042 441 to use cutouts in the reshaping process, as, drawing and embossing. These, however, serve a totally different purpose, namely, to provide the material with flow properties.

The searchers in the individual tools are always able to exactly capture such a strip again. Due to this, the sequential compound stamping technology can also be used in stamping strips,

the length of which necessitated, up to the present time, the use of other technologies.

If the individual tools are mounted in sequence onto the stamping device at a small distance and fixed on division, then the stretch bridges are normally located between the individual tools during the operating stroke and absorb elastically division errors and side bends. Here, it is sufficient, upon arranging the individual tools, to accurately maintain the division to a few tenths of a millimeter.

Fig. 1 shows a sequential compound stamping tool with a subsequently mounted individual tool in the customary design. By carrying out the process according to this invention, tool combinations of individual tools are formed, as they are shown, e.g., in Fig. 2. Fig. 3 shows a stamping strip with stretch bridges, and Fig. 4 shows, enlarged, one embodiment of the stretch bridges. The stretch bridges 1 and 2 of the example of the embodiment shown in Fig. 4, are created by two small cuts 3 and 4 beginning at the strip rim, said cuts lying in the same direction and running perpendicularly to the direction of the strip, and by the small cutout 5 running perpendicularly to the direction of the strip. The idea behind the dimensioning of the stretch bridges 1 and 2 is that the stretch bridges must provide the strip with a sufficient flexibility on the one hand, and on the other hand, with an adequate stability for the effective feeding forces. The tool combinations of the individual

tools, rendered possible by the stretch bridges as seen in Fig. 2, permits to manufacture the tools in a module design. This has the advantage that during the manufacture of the individual tools, several tool makers can simultaneously work at the various tools, which was not possible with the usual sequential compound tools as shown in Fig. 1. Consequently, the manufacturing time of this type of tool lies considerably below those customarily used previously. A further advantage consists in that it is less difficult to manufacture these tools. The risks in the tool manufacture as well are smaller. Supplementary changes are generally cheaper and simpler. Besides, the risk with respect to the manufacture of parts can be reduced in that particularly vulnerable tools, which can be exchanged in simple manner, are manufactured as stand-by tools.

It is also possible not to carry out immediately the separation of the individual parts at the strips provided with the stretch bridges, but to retain the bands in their length, in order to carry out subsequent working operations, as, for example, washing, lubricating, spraying, mounting, etc., at the parts which are lined up in a band-like manner, and thereafter to carry out the separation process.